

IN THE CLAIMS

1. (Original) In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device when said first replica held by said physically remote storage device cannot be updated due to a detected error condition in the storage network;

determining at said first electronic device if said detected error condition still exists in the storage network that prevents updating of said first replica held by said physically remote storage device;

instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica upon determination by said first electronic device that said first replica held by said physically remote storage device can be updated due to a removal of said detected error condition that prevents updating of said first replica held by said physically remote storage device; and

outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica.

2. (Original) The method of claim 1, further comprising the step of, identifying to said first

data replication facility of said first electronic device which of said one or more writes to said local storage device should not be logged when said physically remote storage device cannot be updated.

3. (Original) The method of claim 1, further comprising the step of, instructing said first data replication facility of said first electronic device to automatically output said second replica to said second replication facility once generation of said second replica is complete.

4. (Original) The method of claim 1, further comprising the step of, instructing said first replication facility of said first electronic device to prompt an operator of said first replication facility in order to obtain authorization for said output of said second data replica to said second data replication facility of said second electronic device to update said first replica.

5. (Original) The method of claim 1, further comprising the steps of,
instructing said first replication facility of said first electronic device to halt logging of said one or more writes to said local storage device upon said determination that said first replica can be updated; and

instructing said first replication facility of said first electronic device to initiate generation of said second replica upon said determination that said first replica can be updated.

6. (Original) The method of claim 1, further comprising the step of, instructing said second replication facility of said second electronic device to log said one or more writes to a second local storage device of said second electronic device.

7. (Original) The method of claim 6, further comprising the steps of,

detecting an available communication link in said storage network

between said first electronic device and said second electronic device to transport data between said first electronic device and said second electronic device;

prompting said system operator to select a primary replication facility

and a secondary replication facility from amongst said first replication facility of said first electronic device and said second replication facility of said second electronic device;

upon selection by said system operator, instructing said primary replication facility to generate said second replica of data identified in said log; and

instructing said primary replication facility to output said second replica for transmission to said secondary replication facility via said available communication link to update said first replica.

8. (Original) The method of claim 1, further comprising the step of, forwarding from said first data replication facility of said first electronic device to said second data replication facility at said second electronic device information identifying a storage location on said physically remote storage device for storage of said second replica.
9. (Original) The method of claim 1, wherein said outputting from said first data replication facility of said first electronic device to said second data replication facility of said second electronic device occurs in a synchronous manner.
10. (Original) The method of claim 1, wherein said communication protocol comprises the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.
11. (Original) The method of claim 1, wherein said first electronic device and said second electronic device operate without a volume manager facility.
12. (Original) The method of claim 1, wherein said log comprises a bitmap holding one or more bits, wherein each of the one or more bits in the bit map indicates a storage location written to on the local storage device.

13. (Original) In a computer network having a plurality of programmable electronic devices, wherein each of said plurality of programmable electronic devices operates as a host device for a data replication facility for replicating data among said plurality of programmable electronic devices, a method to handle a communication link failure in said computer network, said method comprising the steps of,

instructing each said data replication facility of each of said plurality of programmable electronic devices to enter a logging routine should said host device of said data replication facility detect said communication link failure, wherein said logging routine halts said replicating of data by said replication facility of said host device and said replication facility of said host device identifies in a log each local write of said host device that detects said communication link failure; and

instructing each said data replication facility of each of said plurality of programmable electronic devices that initiated said logging routine to generate a replica for each said local write identified in said log upon reestablishment of said communication link.

14. (Original) The method of claim 13, further comprising the steps of,

grouping each said replica into a single data set; and
forwarding said single data set in accordance with a communication protocol from a first of said plurality of programmable electronic devices to a second of said plurality of programmable electronic devices.

15. (Original) The method of claim 14, further comprising the step of, packaging with said single data set information identifying a storage location for storage of said single data set on a storage device of said second of said plurality of programmable electronic devices.

16. (Original) The method of claim 14, wherein said first of said plurality of programmable electronic devices forwards said single data set in a synchronous manner.

17. (Original) The method of claim 14, wherein said communication protocol comprises the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.

18. (Original) The method of claim 13, wherein each of said plurality of programmable electronic devices in said computer network operate without a volume manager facility.

19. (Original) A readable medium holding programmable electronic device readable instructions to perform a method in a storage network to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first programmable electronic device in said storage network to enter a first state to log one or more writes to a local storage device when said first replica held by said physically remote storage device cannot be updated due to a detected error condition that does not allow transmission of data to said physically remote storage device;

determining at said first programmable electronic device if said first replica held by said physically remote storage device can be updated due an abatement of the detected error condition;

instructing said first data replication facility of said first programmable electronic device to replicate data corresponding to the one or more writes identified in said log in order to create a second replica upon determination by said first programmable electronic device that said first replica held by said physically remote storage device can be updated; and

outputting said second replica in accordance with a communication protocol from said first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with said physically remote storage device in said storage network to update said first replica.

20. (Original) The readable medium of claim 19, further comprising the step of, identifying to said first data replication facility of said first programmable electronic device which of said one or more writes to said local storage device should not be logged when said physically remote storage device cannot be updated.

21. (Original) The readable medium of claim 19, further comprising the step of, instructing said first data replication facility of said first programmable electronic device to automatically transmit said second replica to said second replication facility once creation of said second replica is complete.

22. (Original) The readable medium of claim 19, further comprising the step of, at said first replication facility of said first programmable electronic device, prompting an operator of said first replication facility to obtain permission for said outputting of said second data replica to said second data replication facility of said second programmable electronic device to update said first replica.
23. (Original) The readable medium of claim 19, further comprising the steps of,
instructing said first replication facility of said first programmable electronic device to exit said first state upon said determination that said first replica can be updated; and
instructing said first replication facility of said first programmable electronic device to enter a second state to initiate creation of said second replica upon said determination that said first replica can be updated.
24. (Original) The readable medium of claim 19, further comprising the steps of,
detecting a communication link failure in said storage network
between said first programmable electronic device and said second programmable electronic device; and
instructing said second replication facility of said second programmable electronic device to enter said first state to log one or more writes to a second local storage device coupled to said second programmable electronic device.

25. (Original) The readable medium of claim 24, further comprising the steps of,
- detecting an available communication link in said storage network
- between said first programmable electronic device and said second programmable electronic device to transport data between said first programmable electronic device and said second programmable electronic device;
- prompting said system operator to select a primary replication facility
- and a secondary replication facility from amongst said first replication facility of said first programmable electronic device and said second replication facility of said second programmable electronic device;
- upon selection of said primary replication facility by said system operator, instructing said primary replication facility to enter said second state to create said second replica of data identified in said first state; and
- instructing said primary replication facility to output said second replica for transport via said available communication link in said storage network to said secondary replication facility to update said first replica.
26. (Original) The readable medium of claim 19, further comprising the step of, forwarding from said first data replication facility of said first programmable electronic device to said second data replication facility at said second programmable electronic device information identifying a storage location on said physically remote storage device for storage of said second replica.

27. (Original) The readable medium of claim 19, wherein said outputting from said first data replication facility of said first programmable electronic device to said second data replication facility of said second programmable electronic device occurs in a synchronous manner.

28. (Original) The readable medium of claim 19, wherein said communication protocol comprises the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.

29. (Original) The readable medium of claim 19, wherein said first programmable electronic device and said second programmable electronic device operate without a volume manager facility.

30. (Original) The readable medium of claim 19, wherein said log comprises a bitmap to hold one or more pointers, wherein each of the one or more pointers indicate a location on a storage device written to during said first state.

31. (New) In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device when said first replica held by said physically remote storage device cannot be updated due to a detected error condition in the storage network;

determining at said first electronic device if said detected error condition still exists in the storage network that prevents updating of said first replica held by said physically remote storage device;

instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica upon

determination by said first electronic device that said first replica held by said physically remote storage device can be updated due to a removal of said detected error condition that prevents updating of said first replica held by said physically remote storage device;

instructing said first replication facility of said first electronic device to halt logging of said one or more writes to said local storage device upon said determination that said first replica can be updated; and

outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica.